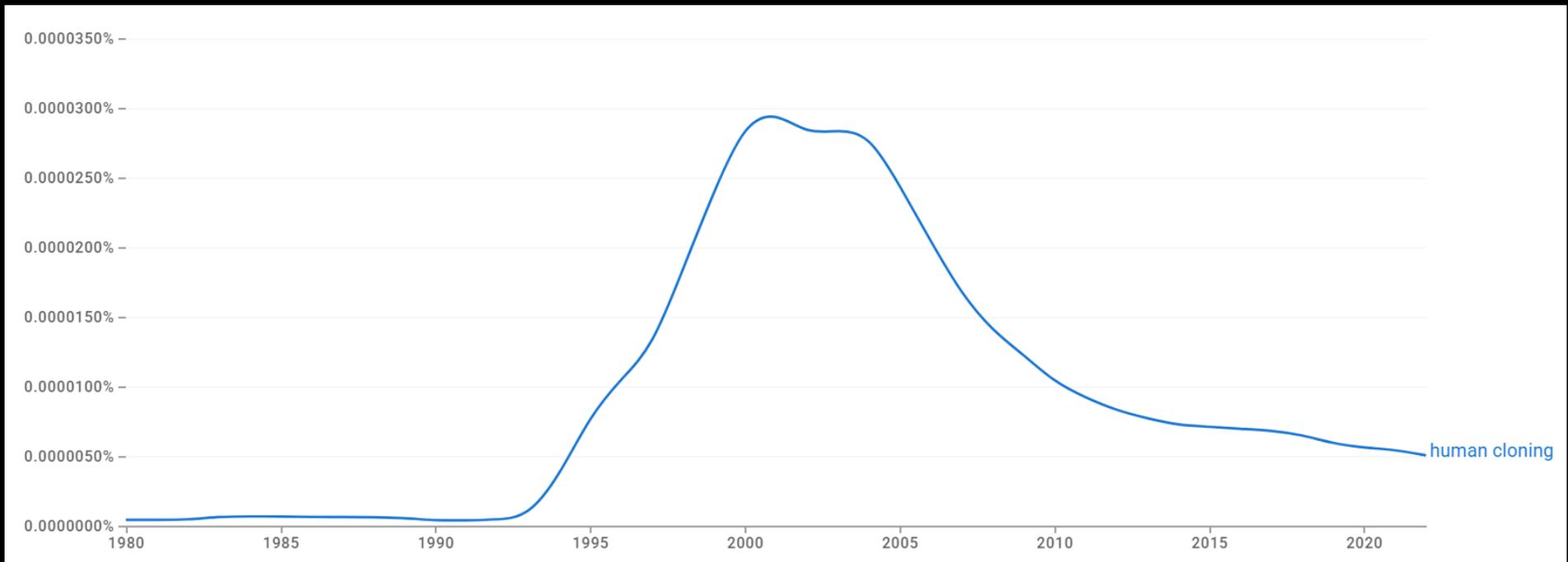


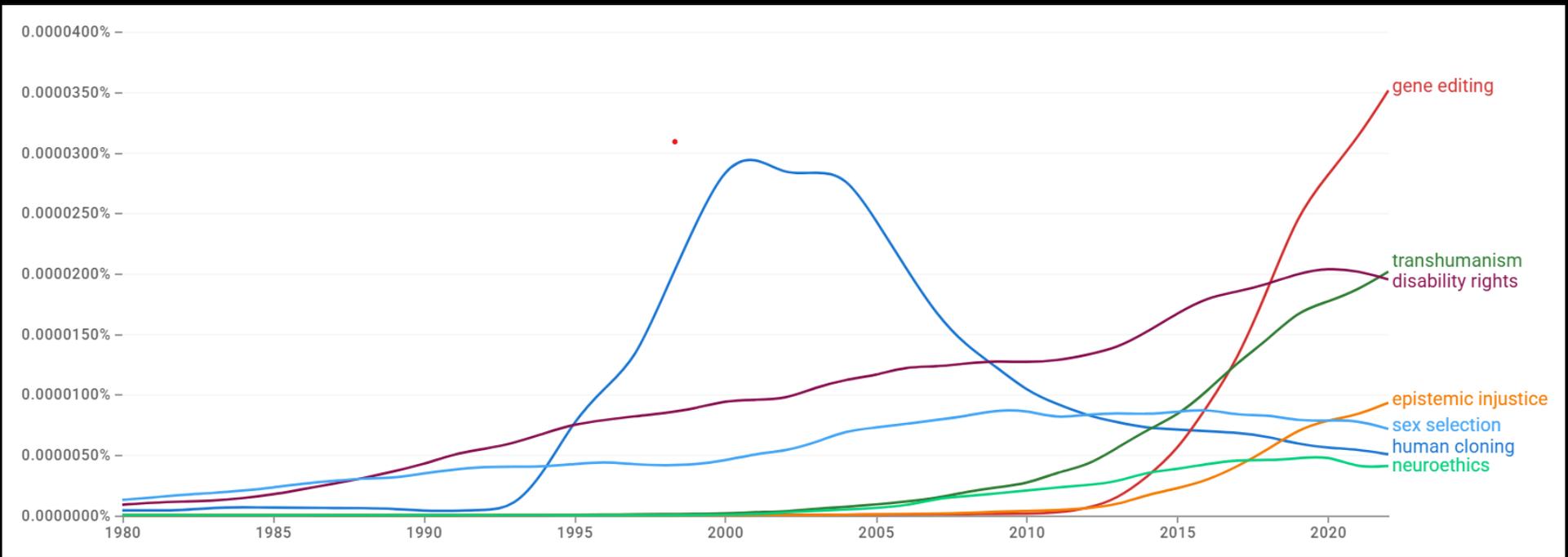


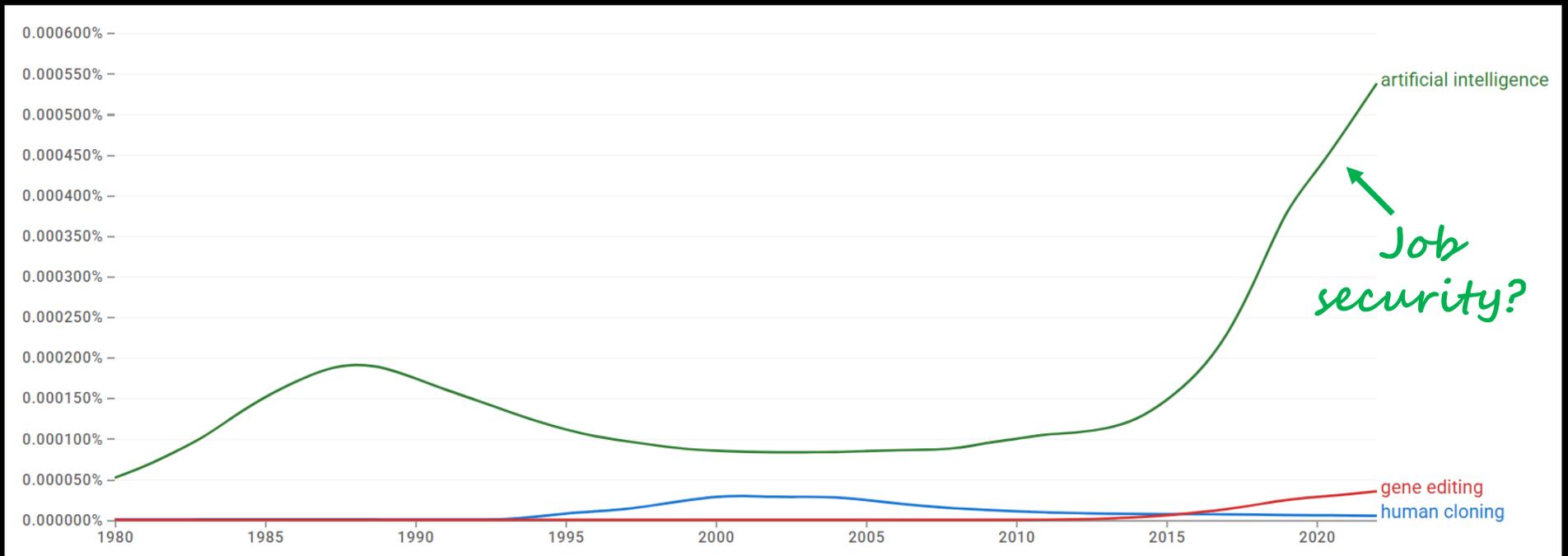
# Exhuming Dolly's corpse

Reproductive cloning after SCNT

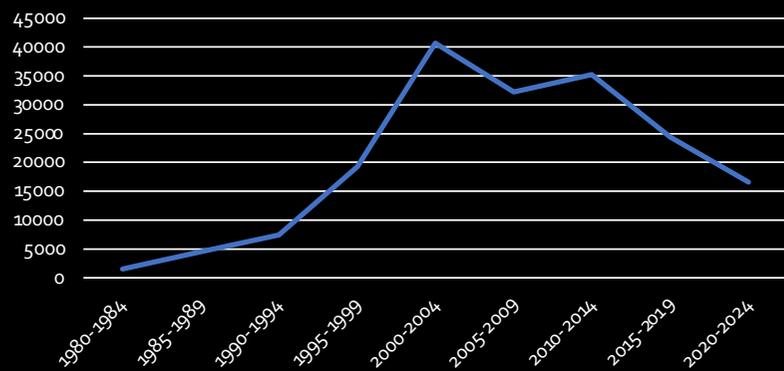


**Google ngrams** – frequency of words across all words published in books in that year

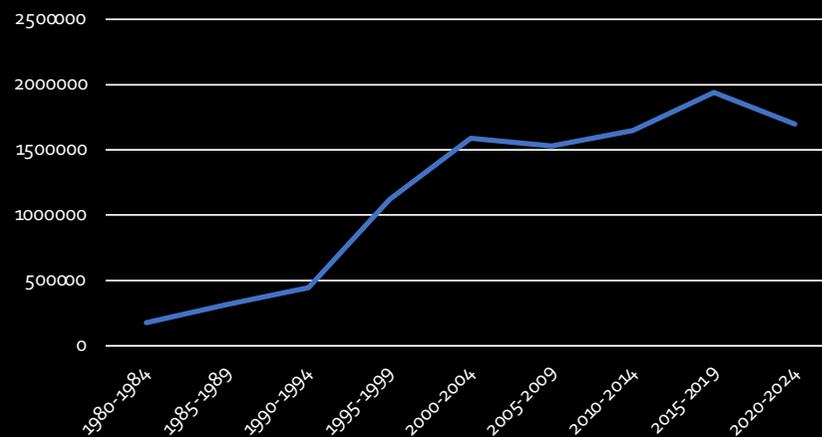




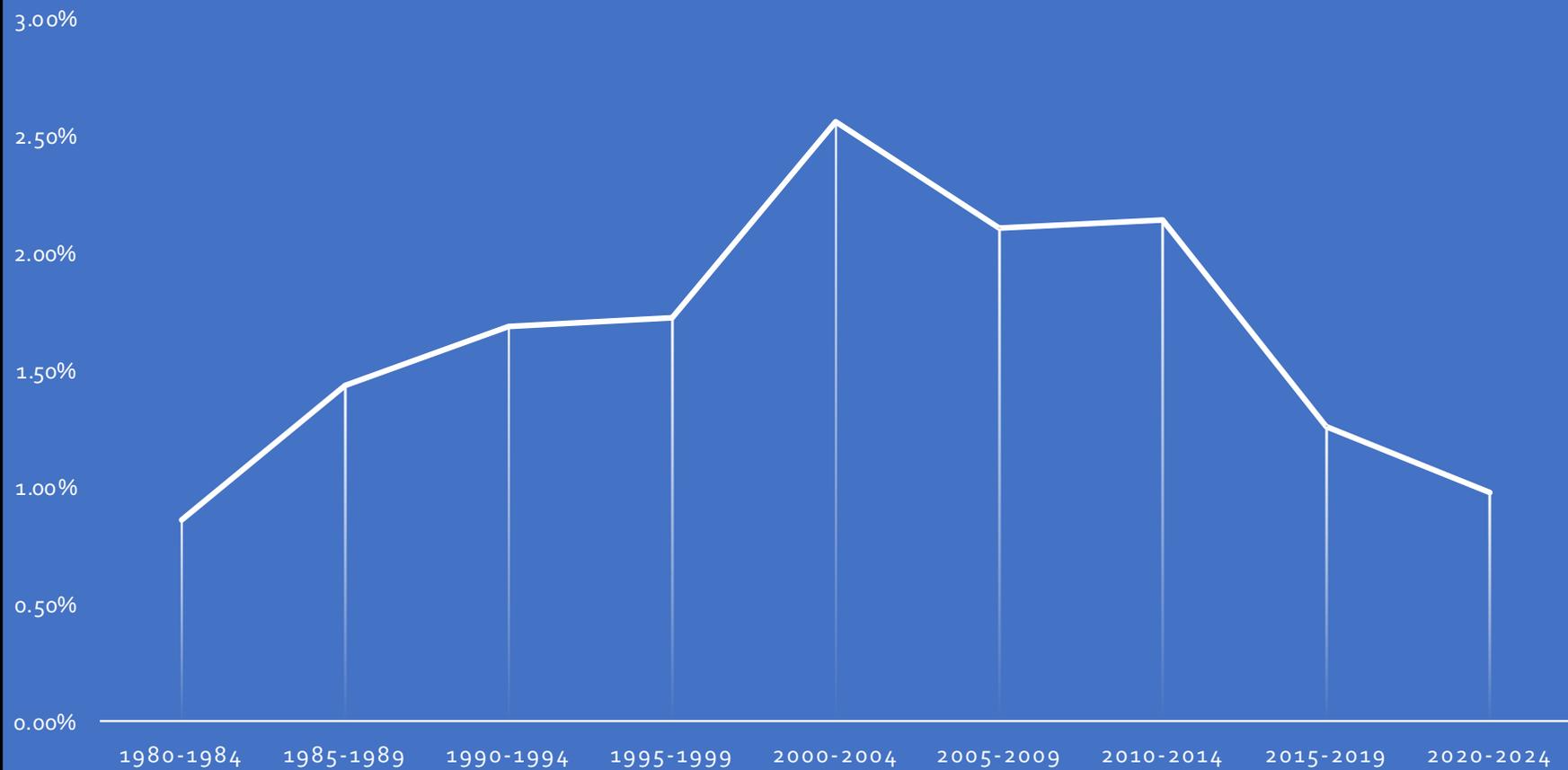
gScholar results: human cloning, ethics OR bioethics



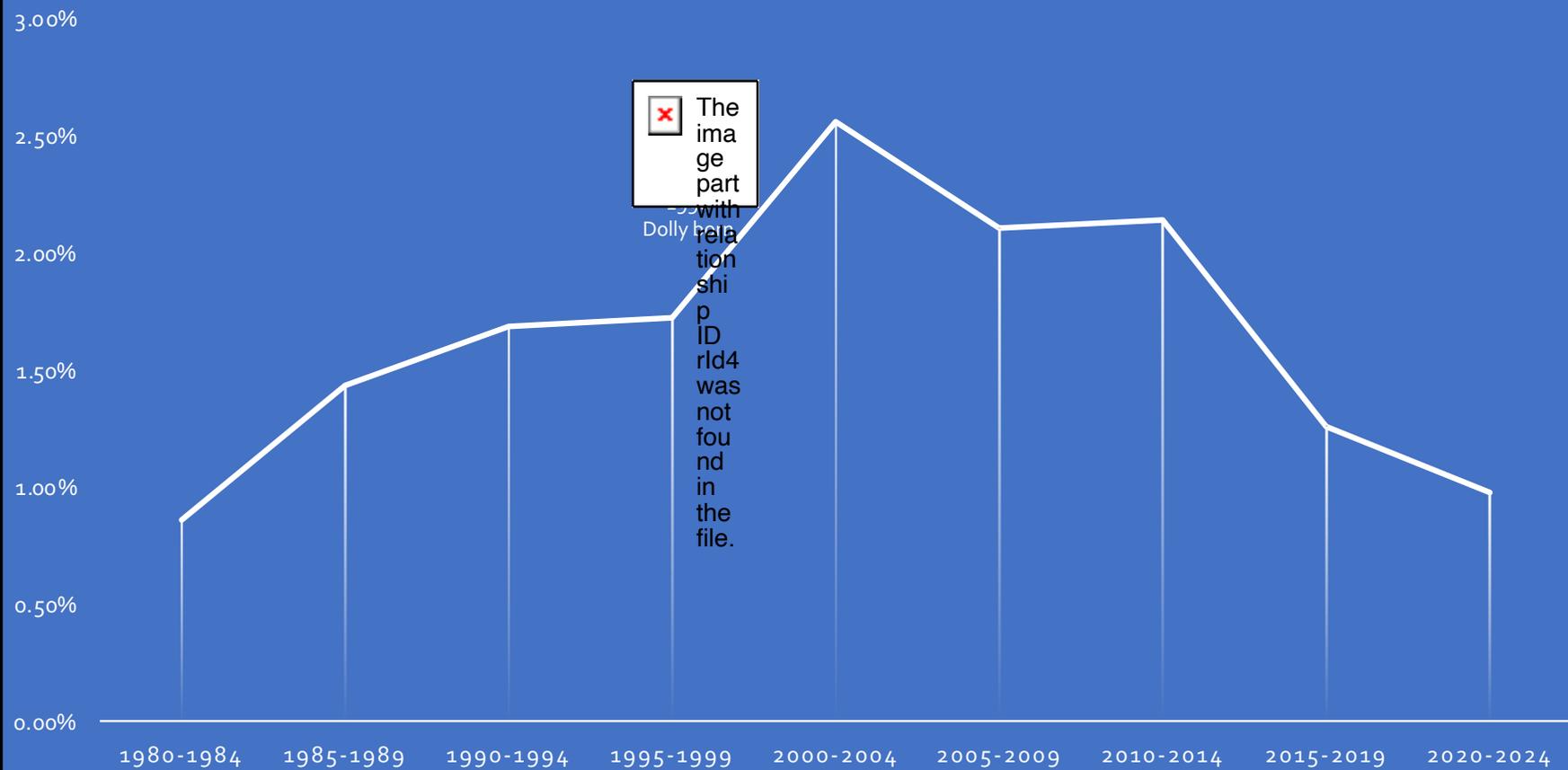
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## SHARE OF (BIO)ETHICS-RELATED PAPERS MENTIONING HUMAN CLONING

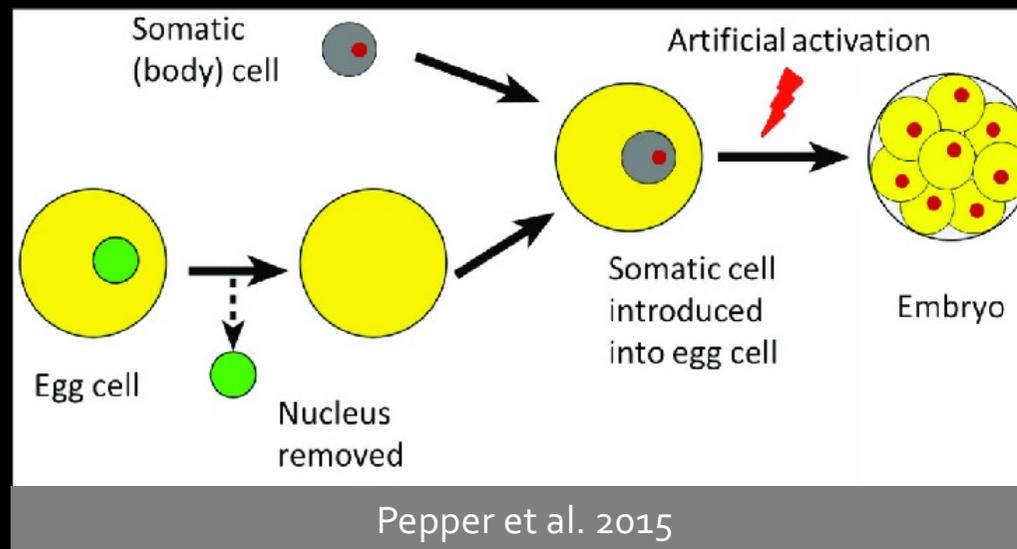


# SHARE OF (BIO)ETHICS-RELATED PAPERS MENTIONING HUMAN CLONING



# Dolly

- The talk of the town!
- Created via SCNT (“Somatic Cell Nuclear Transfer”)



# Dolly

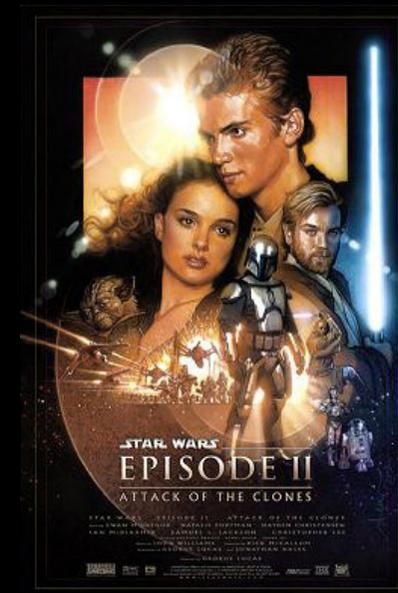
- 1997: Human reproductive cloning seemed like a real possibility
  - Significant public interest, media interest, and bioethical attention



2005

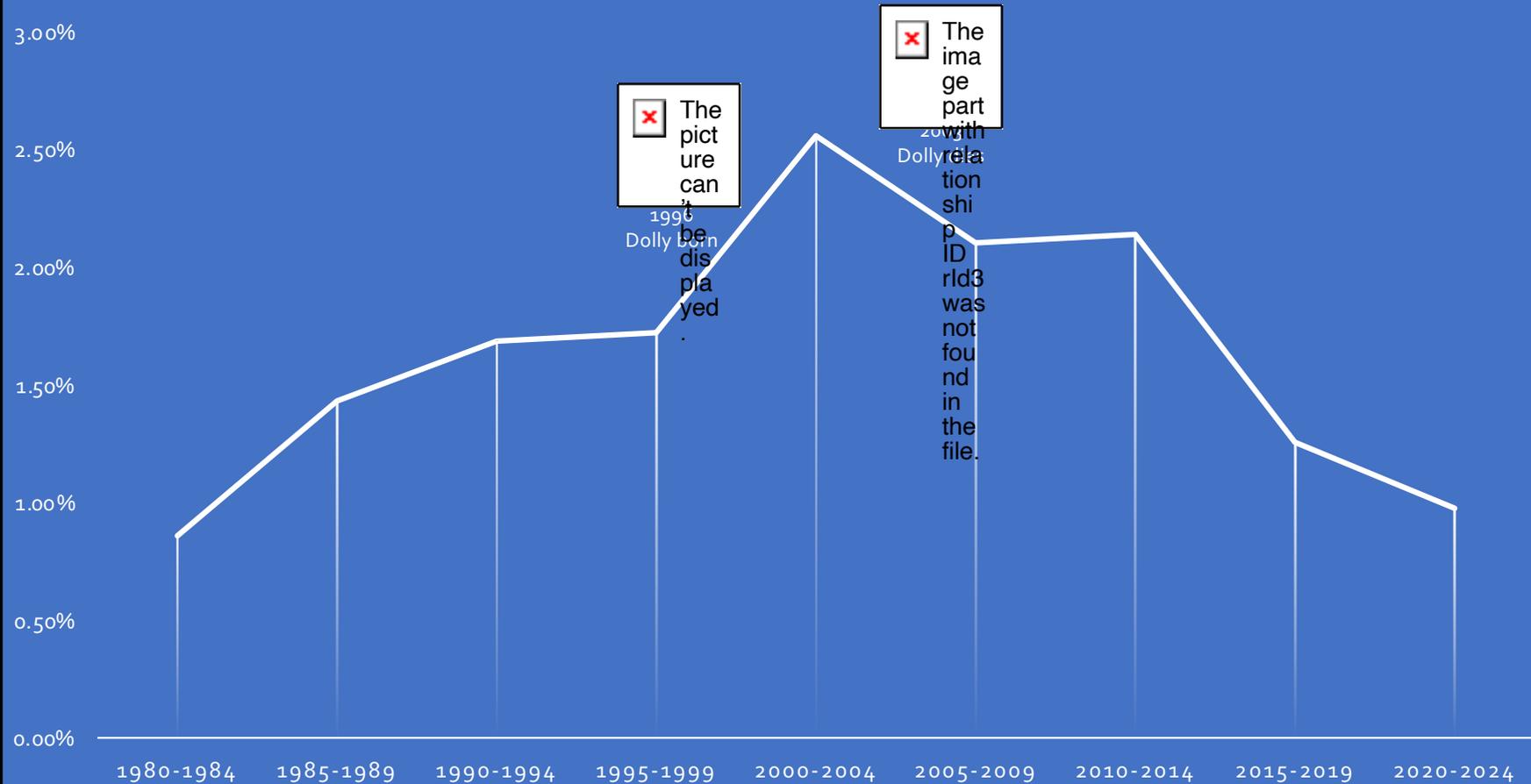


2000

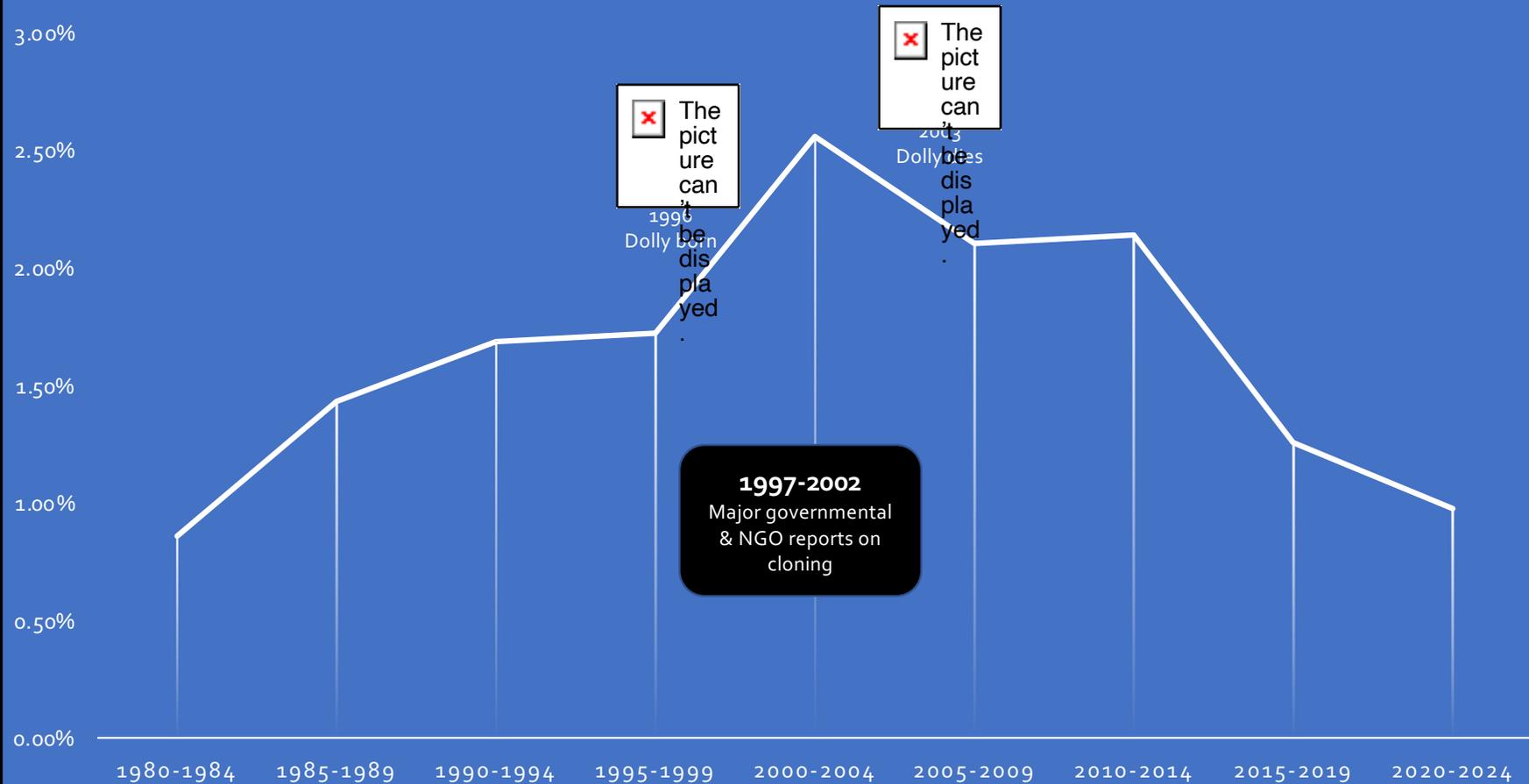


2002

# SHARE OF (BIO)ETHICS-RELATED PAPERS MENTIONING HUMAN CLONING



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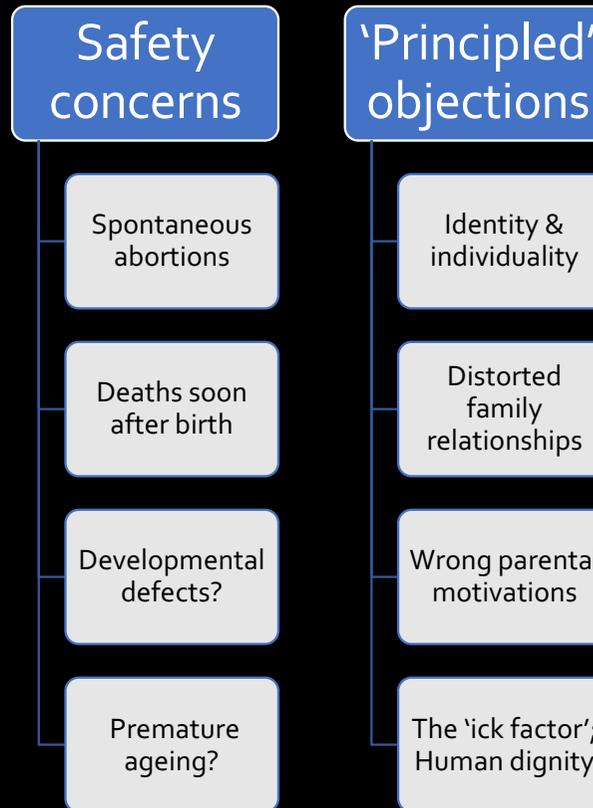
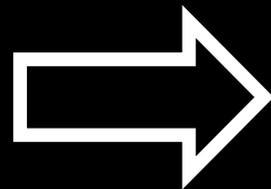


# Inquiries & reports

US National  
Bioethics Advisory  
Commission (NBAC)  
1997

Australian House of  
Representatives  
report (2001)

Joint Working Group:  
UK Human Genetics  
Advisory Commission  
& UK HFEA (1998)

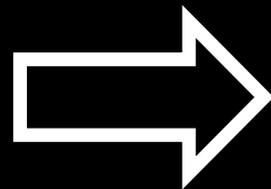


# Inquiries & reports

US National Bioethics Advisory Commission (NBAC) 1997

Australian House of Representatives report (2001)

Joint Working Group: UK Human Genetics Advisory Commission & UK HFEA (1998)



## Safety concerns

Spontaneous abortions

Deaths soon after birth

Developmental defects?

Premature ageing?

## 'Principled' objections

Identity & individuality

Distorted family relationships

Wrong parental motivations

The 'ick factor'; Human dignity

## Public attitudes

Robustly anti-cloning

# Australian House of Representatives report (2001)

- **Safety**

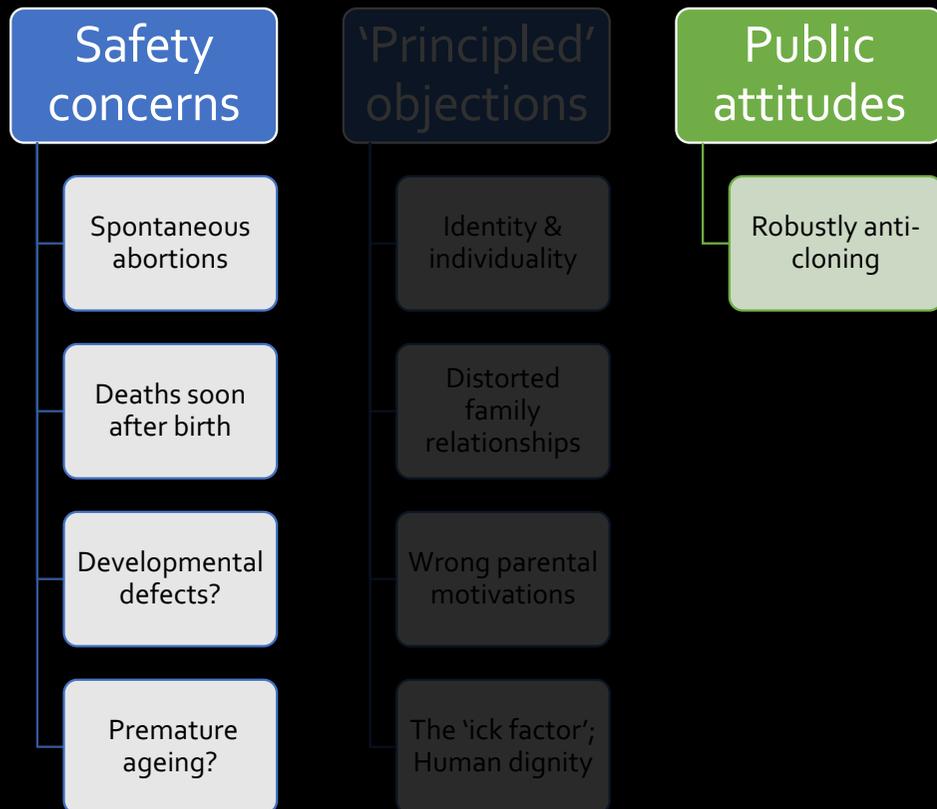
- “The **clear evidence is that it would be unsafe...** ‘Dolly’ was produced only after 276 attempts, many of which resulted in miscarriages, deformities and still births.”

# Australian House of Representatives report (2001)

- **Safety**

- “Safety is itself an ethical issue... In humans, the wastage of human eggs and the **high risks of miscarriage and congenital malformation** alone would exclude any realistic prospect of reproductive cloning”
- Still (!! ) appears to be risky and inefficient, especially in non-human primates

# Ethical issues moot?

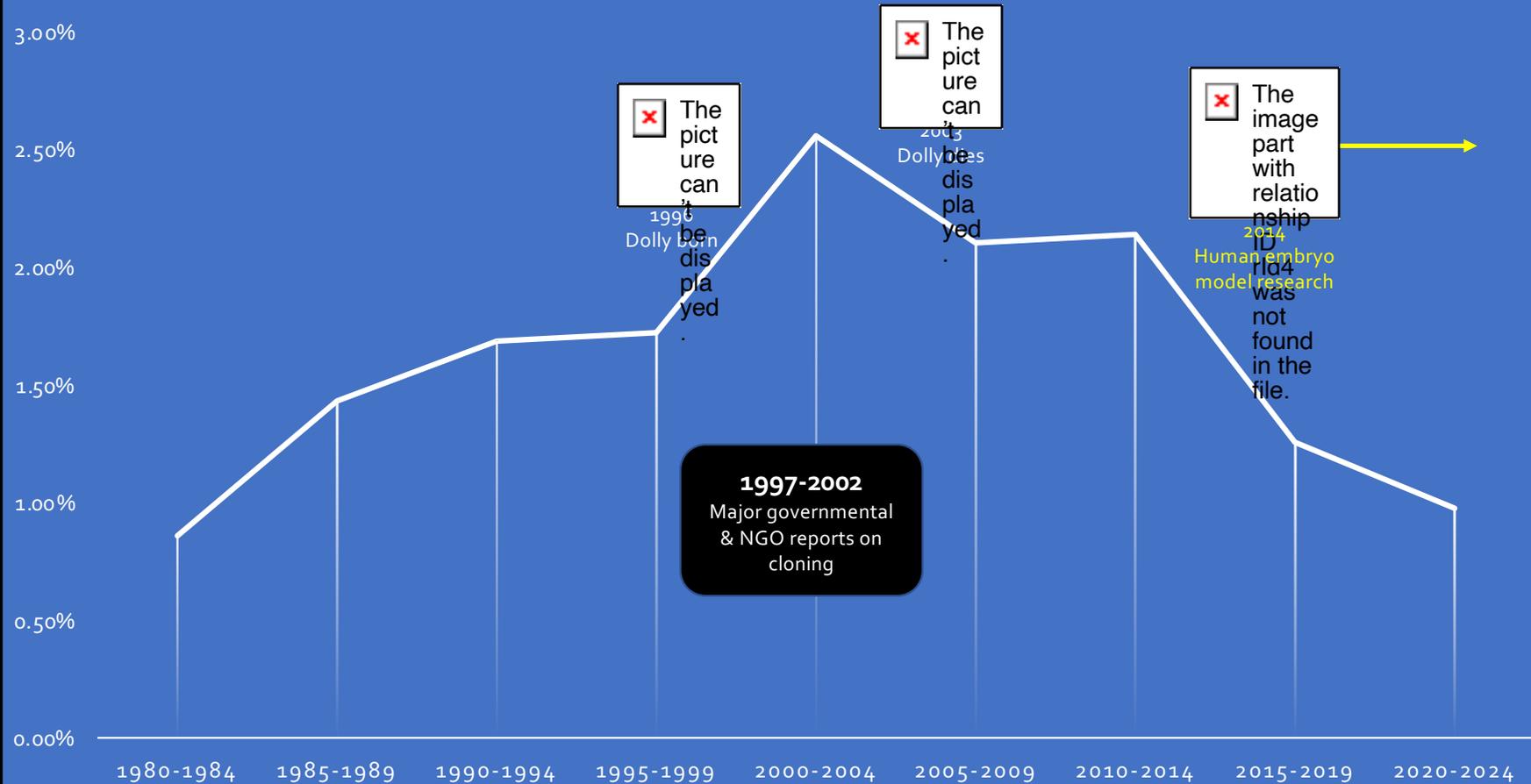


- (Currently) irresponsible to practice
- Doesn't meet any obvious urgent need
- No major political movement to implement something unsafe and unpopular...

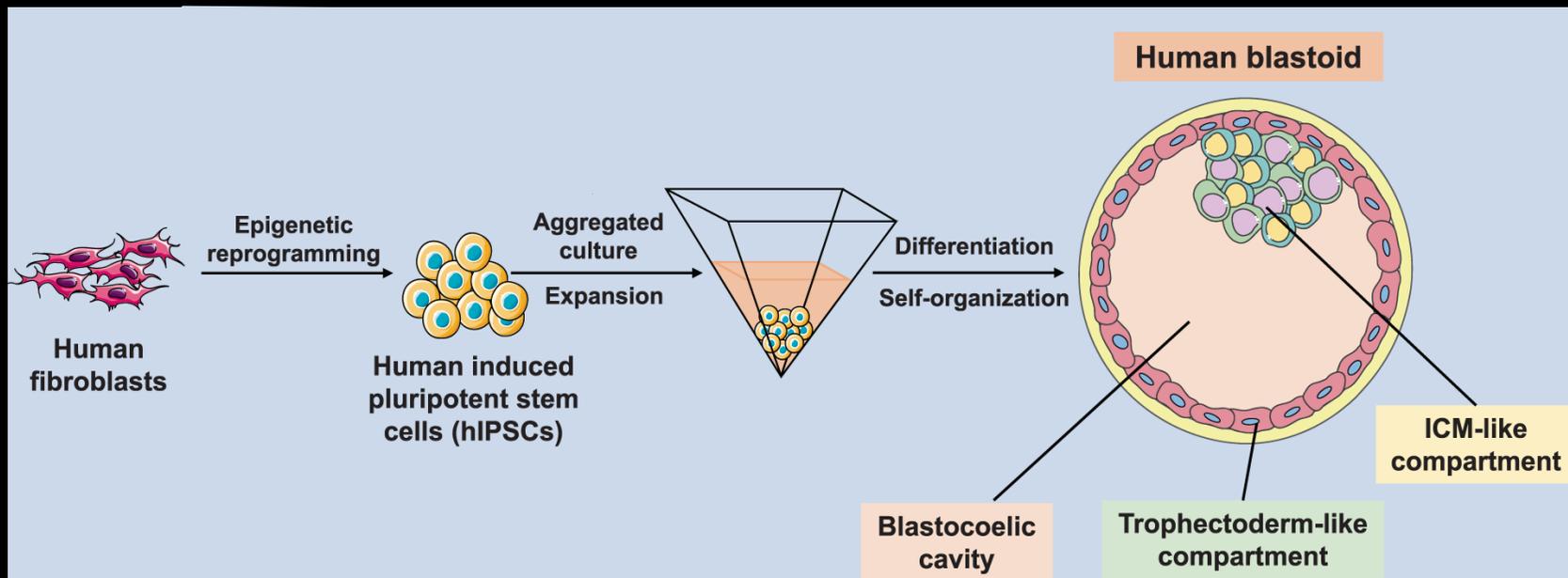
# Done!

- Thanks to Alejandro de los Angeles, Julian Savulescu...
- ... and you!!

# SHARE OF (BIO)ETHICS-RELATED PAPERS MENTIONING HUMAN CLONING

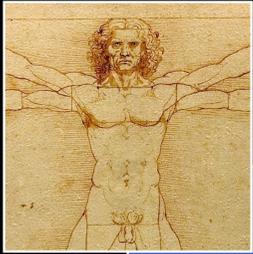


# Stem cell-based embryo models



Above: Blastoid embryo model

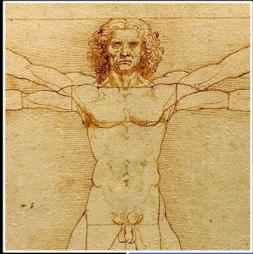
# Progress...



## Humans

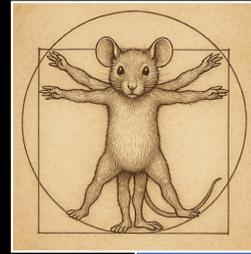
- 2023: Creation of 'complete' human embryo 'model'
- All cell types found in embryo + structures needed for development (e.g., yolk sac and placenta)

# Progress...



## Humans

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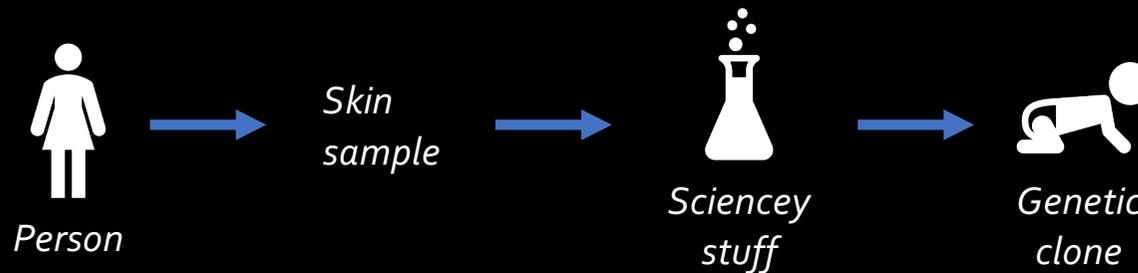
## Animals

- 2022: Mouse embryo models grown for half of a mouse's normal gestation period (eight days) using 'external uterus'
- 2023: Pregnancies established in monkeys using monkey blastoid models



# 'De Facto cloning' (De Los Angeles)

- *Might* become possible to bring 'embryo model' to term
  - Aside: the term 'embryo model' would here be misleading...
- Looks to a non-expert like human cloning...



*But!*

# 'De Facto cloning'



*Sciencey stuff*



*Person*



*Skin  
sample*



SCNT	'De Facto Cloning'
<ul style="list-style-type: none"><li>• Transfer of nucleus from somatic cell to donor egg</li></ul>	<ul style="list-style-type: none"><li>• Reversion of somatic cell to embryo-like state</li></ul>



*Genetic  
clone*

# 'De Facto cloning'



*Sciencey stuff*



*Person*



*Skin  
sample*



SCNT	'De Facto Cloning'
<ul style="list-style-type: none"><li>• Widely prohibited by law</li></ul>	<ul style="list-style-type: none"><li>• Might fall within one of two gaps...</li></ul>



*Genetic  
clone*

# The gaps *(disclaimer: I'm not a lawyer)*

'De facto' cloning: is it cloning?

- **Cloning = SCNT**
  - Several US states
  - Canada: prohibits "manipulation of human reproductive materials or an *in vitro* embryo"

# The gaps *(disclaimer: not a lawyer)*

## 'De facto' cloning: is it cloning?

- **Cloning = SCNT**
  - Several US states: SCNT-specific
  - Canada: clone is created by "manipulation of human reproductive materials or an *in vitro* embryo"

## 'De facto' cloning: does it produce a human embryo?

- **Human embryo = egg fertilised by sperm?**
  - Common internationally
  - Excludes 'de facto clones'

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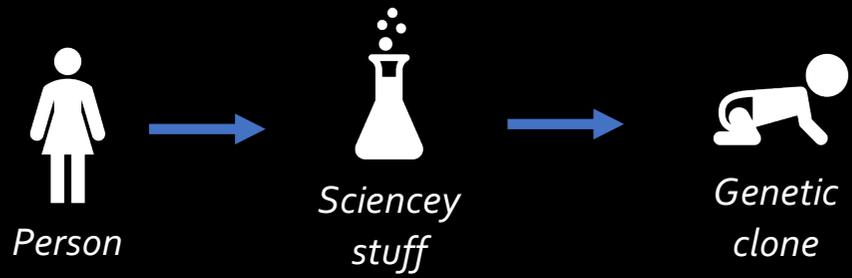
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## 'De facto' cloning: does it produce a human embryo?

- **Human embryo = egg fertilised by sperm?**
  - Common internationally
  - Excludes 'de facto clones'
- **Human embryo = human entity with developmental potential**
  - Australia: human embryo = biological entity with a human nuclear genome that can develop to or beyond primitive streak (~14 days)

# Next step...



# “Julian, settle down now”

Neither gap exists in Australia... so we're fine!!

**But:**

- Legal picture differs internationally...
  - UK: According to Emily Jackson, a SCBEM (*her term*) / 'de facto clone' (*my term*) could be implanted & brought to term without apparently violating any laws
- ... and Australians already engage in reproductive tourism to evade local restrictions...
  - Australians & international *commercial* surrogacy
  - Australians & international travel for sex selection

Coming soon...

**MeWe**

From *me* – to *us*

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# Human Reproductive Cloning

Achieving the reproductive dreams  
of domestic and international clients

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## Even within Australia...

Global push (e.g., from ISSCR) *against* treating 'stem cell-based embryo models' (possibly eventually including 'de facto clones') as embryos in legal & regulatory contexts

→ Pressures on Australian law?

“Okay, Julian, what should we do?”



Head in sand (v1)

- Everything is probably fine?

# “Okay, Julian, what should we do?”



Head in sand (v1)

- Everything is probably fine?



Head in sand (v2)

- Address later, if it starts happening

# “Okay, Julian, what should we do?”



Head in sand (v1)

- Everything is probably fine?



Head in sand (v2)

- Address later, if it starts happening



Embrace gaps

- Let's get cloning!

# “Okay, Julian, what should we do?”



## Head in sand (v1)

- Everything is probably fine?



## Head in sand (v2)

- Address later, if it starts happening



## Embrace gaps

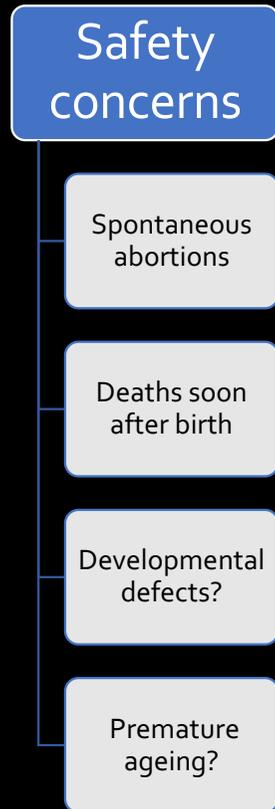
- Let's get cloning!



## Plug gaps

- Support global bans
- Deter/prohibit 'cloning tourism'

# OPTION #5: Re-open the debate



- 'De Facto' cloning may be safer (... and probably much more efficient...)

# OPTION #5: Re-open the debate

## 'Principled' objections

Identity & individuality

Distorted family relationships

Wrong parental motivations

The 'ick factor';  
Human dignity

- Would probably play out differently today
  - Less discomfort with genetic engineering/alteration
  - Less reverence for traditional family structures
  - Great weight placed on reproductive projects
    - State-funded IVF
    - Mitochondrial replacement techniques
  - Some objections to SCNT don't apply to 'de facto' cloning
    - No need for donor eggs...

# OPTION #5: Re-open the debate

- Still unpopular, but...
  - Reactions might be *less strong*
    - (E.g., reactions to incest after Game of Thrones)
  - Greater acceptance of diverse family structures since 1990s
    - Gay marriage only legalised in Aus in 2017

Public attitudes

Robustly anti-cloning

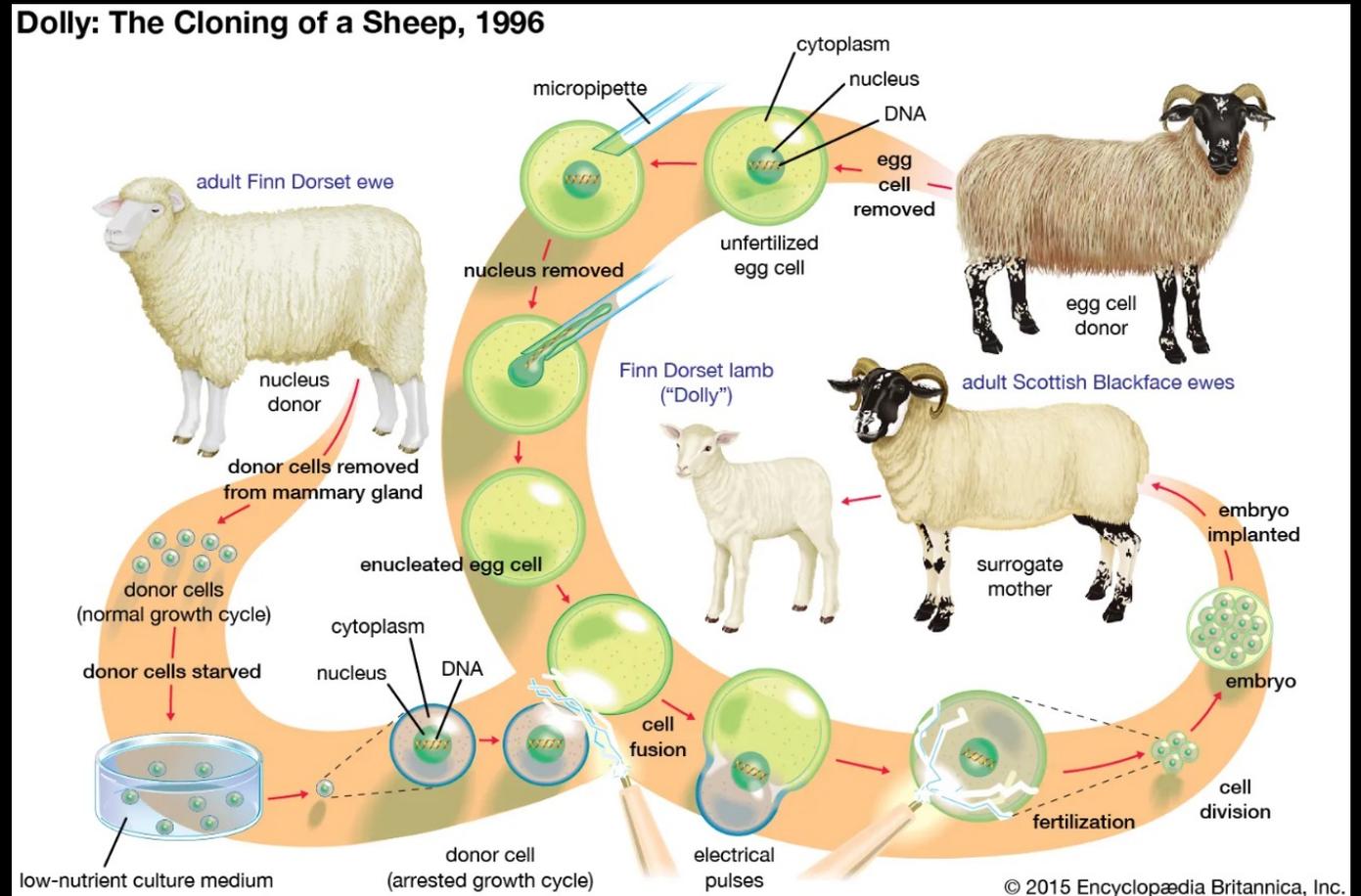
# Takeaway #1

**Should we allow (travel for) 'de facto' cloning, if (sufficiently) safe?**

- Probably??

# Takeaway #2

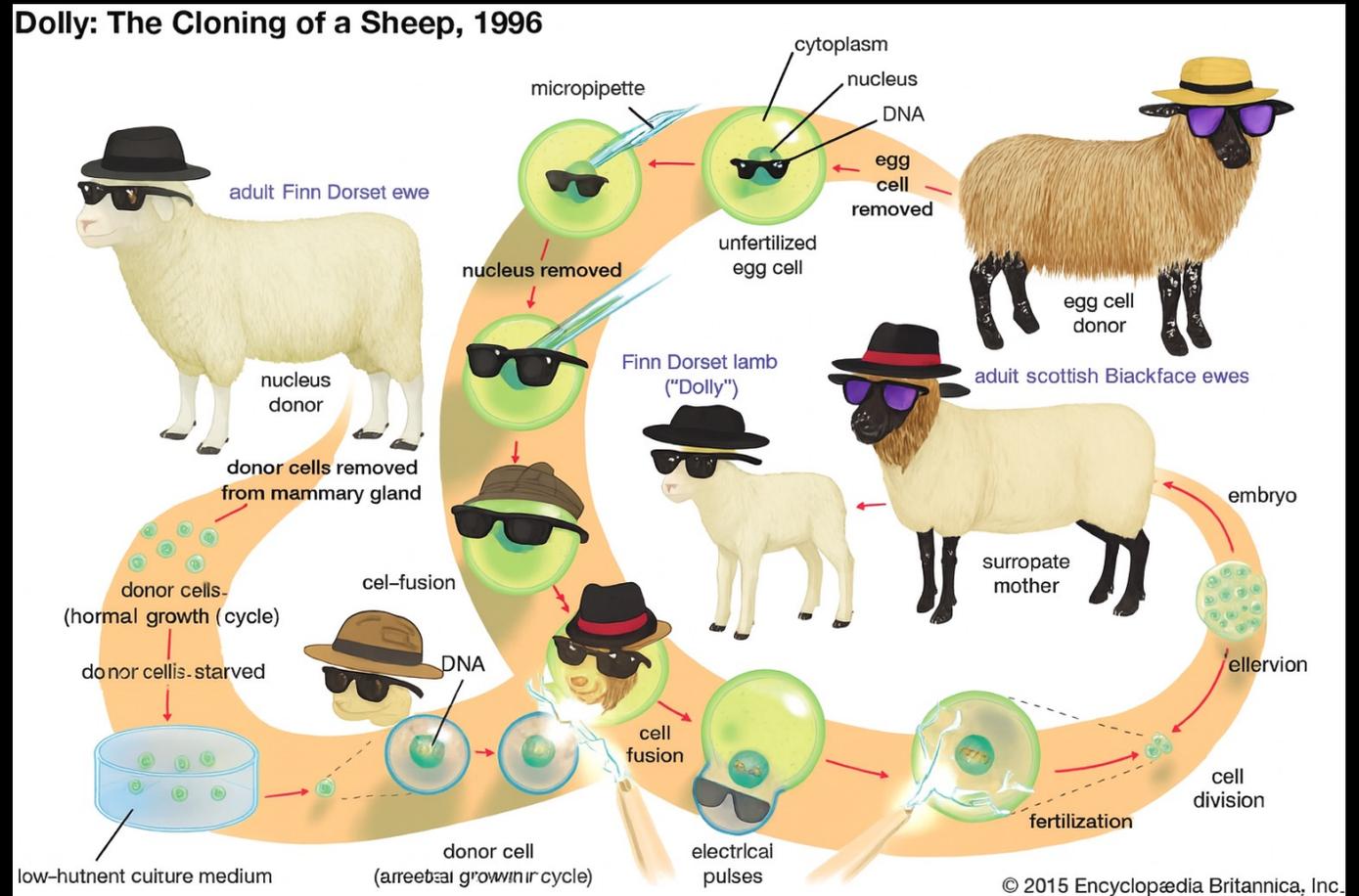
Let's make  
(talking about)  
cloning cool  
again!



# Takeaway #2

Let's make  
(talking about)  
cloning cool  
again!

Dolly: The Cloning of a Sheep, 1996



## SHARE OF (BIO)ETHICS-RELATED PAPERS MENTIONING HUMAN CLONING

